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CERTIFICATION OF TRANSLATION

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am the translator of the documents attached and certify that
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- 1 -

METHOD FOR OPERATING A PROGRAMMABLE WASHING MACHINE

The invention relates to a method for operating a programmable washing machine comprising a laundry drum
5 arranged rotatably inside a soap-solution container, which can be moved program-dependently with different speed profiles in both directions of rotation and comprising a real-time clock by means of which the user himself can determine the beginning or end of the
10 washing process.

Appliances are supplied by a number of washing manufacturers in which an anti-crease function is fixedly installed as a section incorporated after the
15 final spin. In these known appliances the anti-crease program section or the duration and sequence is the same and fixedly predetermined for all types of laundry and all loads. The user of the washing machine merely has the possibility for switching off the anti-crease
20 system. Further interventions are not provided.

In washing machines during spinning at the high speeds normal today, it regularly occurs that a ring of laundry forms on the inner wall of the drum which
25 frequently does not become detached even after the drum has stopped. This results in increased creasing and makes it difficult to unload the drum. The laundry ring has a very disadvantageous effect when a drier is integrated in the automatic washing machine. An non-
30 detached laundry ring hinders uniform and rapid drying of the washing. In order to counteract this, an anti-crease operation is incorporated after the spinning in many washing machines. In this case, the drum is moved for a short time at a speed below the feed speed in
35 several intervals in the direction opposite to the direction of rotation during spinning. In many cases,

this is sufficient to detach the laundry from the drum and disentangle it.

Such a reversal of the direction of rotation to
5 disentangle the washing in the drum is known from DE 41
15 776 A1 as an intermediate step during rinsing and
spinning wherein here the emphasis is not on the anti-
crease system but the redistribution of the washing in
the drum for better rinsing and final rinsing of the
10 individual items of laundry. DE 198 31 617 A1 describes
a method for determining the quantity of washing in a
drum in which a plurality of laundry disentanglement
steps are provided for error correction.

15 The methods described with the fixedly predetermined
parameters for speed, acceleration and braking speed
are not optimal with reference to effective anti-crease
system. With the known methods or process steps the
anti-crease function cannot be adapted to the different
20 conditions such as load and textile properties of the
washing. The methods provide no satisfactory certainty
that the laundry ring is actually detached. This is
especially problematical at speeds above 1400 min^{-1} at
which the laundry ring adheres tightly to the inner
25 wall of the drum and is inherently relatively stable.

DE 199 47 307 C1 describes a method in which the final
spin is followed by a program section in which the
detachment of the laundry ring from the inner wall of
30 the drum is monitored by measurement technology. For
this purpose the mechanical vibrations of the soap-
solution container as a result of falling washing are
recorded. This is accomplished by evaluating the
dynamic signal fraction of a position or force sensor
35 or by evaluating the signals of an acceleration sensor.
In order to avoid misinterpretations of the measurement
data for very small quantities of laundry, the

weighting value which was determined during the washing process or input by the user, is incorporated during the internal evaluation by the microprocessor control system. After identifying a laundry ring, an attempt is
5 made to detach the laundry ring by controlling the drum drive with short and strong accelerating or braking pulses. The success of this measure is then checked by re-evaluation of the sensor signal.

10 The method described also provides no possibility for intervening in the automatically running program and individually manipulating according to the wishes and experience of the user. The success of the method described in relation to the detachment of a laundry
15 ring adhering to the inner wall of the drum depends only on the sensitivity and accuracy of the sensors, which is problematical with very small amounts of laundry or very light laundry.

20 It is the object of the invention to provide an improved method for loosening the washing after the final spin in which the user can himself determine the anti-crease program within broad limits according to his wishes and experience. It is further the object of
25 the invention to support the user as far as possible in selecting the parameters which can be adjusted and selected by him for the sequence of the anti-crease program and to improve the detection of a laundry ring.

30 The object is solved according to the invention by the features specified in the principal claim. Additional advantageous embodiments of the inventive method are specified in the dependent claims.

35 The invention represents an extension and further improvement of known washing methods in respect to careful treatment of the laundry, especially with

regard to an optimal loosening of the textiles after the spinning. In this case, the user is given the possibility of actively influencing the program. It is important to the invention that the anti-crease program
5 as defined by the invention can be freely programmed with reference to its start and end time, the running time and the sequence. The user can independently configure the anti-crease system according to the given individual conditions and according to his personal
10 wishes and experiences. In this case, in the embodiment of the invention the user is supported by the program by the internal determination of default values for the parameters which can be manipulated by monitoring the detachment of laundry rings which form on the inner
15 wall of the drum during the spinning.

The invention is explained subsequently in detail with reference to a program example shown in the drawings.

20 In this example, a washing machine with an intelligent expert system and a display indicator on which important information is made visible to the user and with which a dialogue operation with the user is possible is taken as the starting point. The program
25 sequence is shown schematically by a speed-time diagram where specific details have been eliminated since these are not important for the understanding of the invention. The washing machine is operated during the operations "wash" and "rinse" beginning at time t_{ws} at
30 low speeds in reversing mode, i.e. with alternating direction of rotation. For reasons of simplification in the diagram the edges of the reversing cycles are shown as verticals whereas in reality the drum is accelerated slowly, i.e., in an energy-saving fashion, to the
35 desired speed. The same applies to the reversing cycles of the anti-crease operation.

Shown following the washing phase, identifiable from the high speeds, are a rinsing section and two spinning operations with an interposed loosening operation in which the laundry drum is moved at reduced speed
5 compared with the spinning but with an opposite direction of rotation. After the final spinning which is executed at the maximum speed, the actual washing program is ended at time t_{we} .

10 The following anti-crease operation is designed to loosen the laundry in the drum and maintain this state over the time to prevent the laundry already loosened in the drum from being pressed together again in an undesirable fashion by lying too long, creases from
15 forming and making it difficult to remove the individual items of laundry. Apart from a short section at the beginning of the anti-crease operation, this program section following the spinning is determined by a reversal of the drum at constant speed and the same
20 duration of rotation and rest phases until a predetermined end t_e . The parameters for this section can be selected freely in which case the user is supported by the system of the washing machine in the fashion that the user is guided via the display. The
25 programming of the anti-crease operation is described subsequently.

After the usual program selection for the washing process and the entry of additional parameters for
30 manipulating the washing program, the system enquires via the display whether the anti-crease system is required. After confirmation by the user, a duration is indicated on the display which is determined by the intelligent evaluation system depending on the type of
35 textile from a supply of default values fixedly stored in the memory and which determines how long the anti-crease operation should last after the final spin. The

user can shorten or lengthen this pre-determined time by suitable entries. Alternatively to the running time of the anti-crease system the user can select the function "program end time" and determine via this the
5 time at which the program switches off. The duration of the anti-crease operation is then obtained automatically from the time difference between the time of the final spin t_{we} and the selected end time t_e . An incorrect entry of the end time by the user, possibly
10 such that the selected end time lies before the end of the final spin does not result in interruption of the program but merely has the result that the parameter "program duration" is allocated the value "zero", and thus the anti-crease system is not activated at all.
15 Subsequently values for the parameter "speed", "duration of rotation" and "time interval" are indicated to the user in the display which the user can either confirm or correct upwards or downwards.

20 The values set by the user for the anti-crease operation are checked internally in the control system for compatibility with the selected laundry care program, including the additional parameters. For example, if the user selects a too-high speed for
25 delicate textiles, this is indicated in the display, for example by repeated flashing of the numerical value.

All default values indicated automatically by the
30 system are derived from measurement data stored in the memory which has been obtained from a plurality of comparative tests, from the wash program selected by the user including the additionally entered parameters and the loading of the drum detected by a suitable
35 sensor system. The values determined by the internal evaluation system and indicated on a display are determined under the premise of ensuring an effective

anti-crease system which however is as energy-saving as possible. If the anti-crease system is required by the user but is not specified by any entries, the program runs as specified by the default values.

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The first section after the spinning, beginning from the time t_{we} is controlled by the intelligent expert system and runs automatically. The duration of this first section depends on reaching of a target function, i.e., reaching predetermined variables of state which can be valid as the criterion for detachment of the laundry ring adhering to the inner wall of the drum after the final spinning and for a looser disentangled washing. Suitable for this are mechanical, acoustic and optical quantities such as, for example, the speed profile, torque, imbalance, impact noises, reflection and scattered light. The detachment of the laundry ring is monitored by measuring one or a plurality of variables of state at the beginning of the anti-crease operation in the reversing phases and comparing these with desired data which have been determined as the criterion for loosened and disentangled laundry. The desired measured values are determined in a short analysis section (t_a) incorporated before the actual beginning of the wash program (time t_{ws}) in which the drum is moved in two short sections at various speeds. The speed of the first phase is equal to the speed selected for the anti-crease system and in the second phase the drum is moved at the feed speed A. The measured values from the first section correspond to the desired state of a loosened disentangled quantity of laundry items strived for by the anti-crease system. During rotation of the drum at the feed speed the state which is absolutely to be avoided as the final state is measured. Extreme deviations caused by loading the drum with wet laundry are corrected inside the control system. By means of this procedure the monitoring

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measuring device is re-calibrated for each wash run. Especially as a result of the relationship between two measured values comparative values are determined with which errors during identification of a laundry ring, 5 caused by various properties, especially very small loads or weight, caused by textile-specific properties or other rather random features of the washing, can be largely avoided.